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ABSTRACT

PLATO (programmed Logic for Automatic Teaching Operations) is a computer-based teaching system which was developed in the Coordinated Science Laboratory at the University of Illinois to explore the possibilities of automation in individual instruction. The history of the PLATO program is summarized here, along with a list of courses which used PLATO during the academic year 1971-72. A summary by subject area of information about PLATO materials used by students either in the past or at present describes PLATO curriculum materials in the many fields, including accounting, astronomy, medicine, biology, foreign languages, engineering, mathematics, urban planning, and veterinary medicine. A chronological bibliography of all PLATO publications is also provided. (JY)

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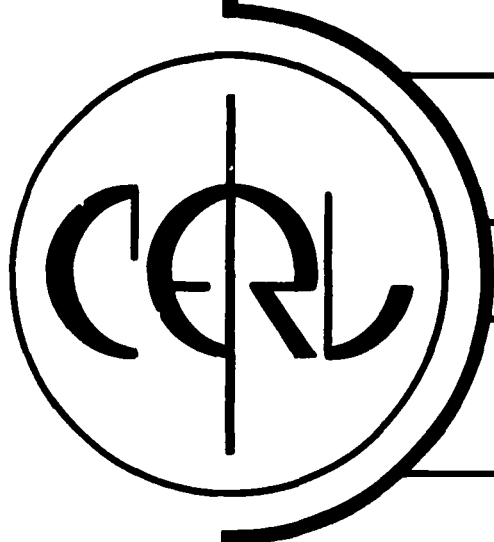
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A SUMMARY OF PLATO CURRICULUM AND RESEARCH MATERIALS

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A SUMMARY OF PLATO CURRICULUM AND RESEARCH MATERIALS

by

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AUGUST, 1972

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A SUMMARY OF PLATO CURRICULUM AND RESEARCH MATERIALS

I. INTRODUCTION

From 1960-1967 a computer-based teaching system called PLATO (Programmed Logic for Automatic Teaching Operations) was developed in the Coordinated Science Laboratory at the University of Illinois in order to explore the possibilities of automation in individual instruction.^{2,3,5,7,12,13,17,33} In the course of development during those first seven years about 300 programs (using about 60 logics and including 181 lessons) were written for the system to illustrate or demonstrate its flexibility for teaching as well as for educational and other research.¹⁶

In January, 1967, the University of Illinois organized the Computer-based Education Research Laboratory for the PLATO project. The laboratory has continued the work on the educational aspects of the PLATO teaching system with particular emphasis on the most efficient use of the present system (PLATO III) and on the development of an economical large-scale computer-based educational system (PLATO IV).^{70,73,95,104,106,121,130}

The PLATO system utilizes a high speed digital computer as the central control element for teaching a number of students simultaneously. The rules governing the teaching process are included in the program placed in core in the central computer during lesson use. A complete set of rules is referred to as a "teaching logic." In the course of development of the PLATO system, many logics were experimented with such as tutorial, inquiry, drill, conversational, simulation, etc.. Most PLATO lessons now contain such a mixture of logic styles in a single lesson that no attempt to categorize the lessons into logic types is made anymore. In the effort to permit maximum flexibility in the system, storage of lesson material

on magnetic tape was abandoned for disk file storage, and a basic interpretive and interactive program was written which includes a flexible author language and editing capability.^{72,116,120,134,135} The author language (called TUTOR) adapts to a wide variety of teaching styles. The TUTOR language allows time-sharing of the system, not only by students (as in the past), but also by authors, or authors and students simultaneously, thus utilizing the computer and the available terminals as efficiently as possible. With the advent of TUTOR, the proliferation of lesson material increased rapidly. As of August 1, 1972, the total number of programs which have been written for the PLATO system since 1960 is about 1600 of which 1400 are lessons with approximately 1100 being available in 40 subject areas for use at the present time. Some University of Illinois students have completed four consecutive semesters of study in one subject area using the PLATO system.

The material in this report will appear also as Sections II, III, IV and X of the 1972 revision of the CERL Report X-2.¹⁶ In this report, CERL Report X-23, section two is a brief chronology of the development of PLATO, section three is a list of courses which used PLATO III during the academic year 1971-1972, section four is a summary by subject area of information about the PLATO materials (PLATO I, II, III) used by students or subjects either in the past or at present, and section five is a chronological bibliography of all the PLATO publications.

In addition to the subject-tested curriculum materials in the areas described in section four, there has been PLATO curriculum material developed

in the following areas: Art History, Aviation, Geography, Graphics, Japanese, Music, Physiology, Reading, Rhetoric, Semantics, and Technical Training. There are also more extensive curriculum materials now ready to be used by students in 1972-1973 in Accounting, English, German, Italian, Library Science, Physics, Reading, Russian, Veterinary Medicine as well as Community College Accounting, Biology, Chemistry, English, Pre-algebra, and Remedial Mathematics.

With the arrival of many commercially constructed PLATO IV terminals during the summer of 1972 and the extensive development of the TUTOR language for PLATO IV, PLATO authors have begun converting their PLATO III lessons to the PLATO IV system. Although PLATO III will be used for teaching the regularly scheduled classes during the fall semester, 1972, it is anticipated that the PLATO III system will be phased out early in 1973, and the PLATO IV system expanded to serve several thousand state-wide users providing high-quality computer-based education at a low cost.

II. HISTORY OF PLATO SYSTEM

June 1960	First design for PLATO complete (single station consisting of keyset and CRT with provision for simultaneous display of computer-generated characters and photographic slides).
Fall 1960	PLATO goes into regular research operation (2 hours per day using ILLIAC I computer) as project of Coordinated Science Laboratory.
November 1960	First formal demonstration of PLATO in operation.
January 1961	PLATO II goes into operation (two stations operating simultaneously).
March 1961	First use of remote terminal with PLATO (30 miles from computer).
Spring 1961	PLATO first used with instructional material (high school math and French grammar).
Fall 1961	College level material first used on PLATO (Network Synthesis lessons).
Spring 1962	PLATO first used to provide part of accredited college course (Math 195, University of Illinois).
Summer 1962	Inquiry type logic developed for PLATO.
November 1962	PLATO first used to collect and process physiological information (heart rate) as part of student response data.
January 1963	PLATO shifts from ILLIAC I to CDC 1604 computer.
Spring 1963	PLATO first used to provide part of accredited professional course (Nursing).
Fall 1963	PLATO III first used (capability for expansion to 32 stations).
June 1964	Two different lessons simultaneously available to class using PLATO.
October 1964	Provision for inter-terminal communication between PLATO terminals completed.
Fall 1964	PLATO used for control of real experiments in physical sciences (all stations able to observe outcome and perform analyses of results).

December 1964	On-line editing of PLATO lesson possible while students use lesson.
January 1965	CATO (Compiler for Automatic Teaching Operations) completed.
Spring 1965	PLATO first used for extensive portion of accredited college course (EE 322).
Fall 1965	First college course (Library Science 195) given completely by PLATO.
March 1966	Expansion of PLATO III to 20 terminals completed.
May 1966	PLATO operating on own CDC 1604 computer.
Summer 1966	Multiple on-line author editing program first used (MONSTER tape editor).
January 1967	Computer-based Education Research Laboratory (CERL) formed for continued operation of and research on PLATO.
Summer 1967	TUTOR author language first used on PLATO (specifically designed for authors with no background in computer use).
March 1968	NSF grant awarded for first steps of development of PLATO IV (ultimately to consist of 4096 student terminals requiring only telephone line communication with a large central computer). Terminals use the plasma display panel developed at the University of Illinois instead of the more costly CRT presentation.
June 1968	Disk storage added giving on-line editing capability to authors while students are operating (any combination of up to 20 authors or students simultaneously operating).
June 1968	Delivery of first commercially produced 4" plasma panel (Owens-Illinois).
December 1968	14 station remote PLATO demonstration center in operation at Mercy Hospital (3 other centers operating by February, 1969).
June 1969	Multiple disk storage in operation. Up to 150 lessons available to student (for use) or authors (for editing) during a class session.
November 1969	1 remote station operating at Springfield High School, Springfield, Illinois, ninety miles from Urbana.

Summer 1970	720 hours of instructional material developed; 100,000 student contact hours of use by this date.
January 1971	On-line remote demonstration for NSF in Washington, D.C..
May 1971	Delivery of first 512 x 512 Digivue display memory device from Owens-Illinois.
June 1971	Delivery of first PLATO IV terminal from Magnavox Company.
Summer 1971	1100 hours of instructional material developed; 130,000 student contact hours of use by this date.
January 1972	Four PLATO IV terminals in operation.
June 1972	20 PLATO IV terminals in operation. On-line PLATO IV demonstrations between January 1972 and June 1972 in many locations from California to Massachusetts, Canada to Texas.
July 1972	On-line PLATO IV demonstrations in Italy and Germany.
August 1972	1600 hours of PLATO III instructional material developed, 154,000 student contact hours of use of the PLATO system to date. Instructional sequences available in about 70 courses.
August 1972	40 PLATO IV Terminals in operation.

III. COURSES USING PLATO III 1971-72
(Fall, Spring, or Summer Session)

COURSES USING PLATO III ON A REGULAR BASIS

<u>Subject Area</u>	<u>Course</u>
Aeronautical Engineering:	UI AAE 224
Biology:	UI BIOL 100,101 UI BIOL 351
Chemistry:	PARK CHEM 101,102,103 PARK CHEM 201,202,203
Chinese:	UI CHIN 201,202,203,301,302
Computer Science:	UI CS 199
Demography:	UI SOC 270
Electrical Engineering:	UI EE 272
Elementary Mathematics:	WASH. SCHOOL 2nd, 3rd grades WASH. SCHOOL 5th, 6th grades
English as a 2nd Language:	UI ESL 111
French:	UI FR 101,102,103,104,313
Latin:	UI LAT 101,102,113,114
Linguistics:	UI SP ED 317,418
Nursing:	PARK NURS 102,103,
Physics:	UI PHYCS 106 UI PHYCS 383
Political Science:	UI POL S 150 UI POL S 315
Psychology:	UI PSYCH 235,332
Russian:	UI RUSS 121,122,400,401
Secondary Education:	UI SE ED 356,490 UI SE ED 357
Spanish:	UI SPAN 101,102
Theoretical and Applied Mechanics:	UI TAM 150

COURSES OCCASIONALLY USING PLATO

Accounting:	UI ACCY 101 student volunteers
Astronomy:	UI ASTR 101,300,306,307
Basic Medical Science:	UI 1st yr. BMS students
Business Administration:	UI B ADM 573
Chemistry:	UI CHEM 101,131,136,181,338,432
Dairy Science:	UI DS 415
Demography:	UI many courses
Economics:	UI ECON 108
English:	UI SEOP students
Music:	UI MUSIC selected students
Urban Studies:	UI UP 376
Veterinary Medicine:	UI VPH 331,338 UI VPP 316

IV. SUMMARY INFORMATION ON SUBJECT-TESTED PLATO III TEACHING OR
RESEARCH MATERIALS UP TO FALL, 1972

ACCOUNTING

PROGRAM NAME: ACCOUNTING PRACTICE
AUTHOR: T. K. Lenehen
DESCRIPTION: Lessons for course in elementary accounting designed to replace class drill and homework. Areas of study include journal entries, balance sheets, terms of sale, accounting transactions, worksheets, financial statements, debts, depreciation, etc..
USE OF PROGRAM: Elementary accounting course, City Colleges, Chicago; UI students in beginning accounting course.
PREREQUISITES: None
TIME SPENT ON PLATO BY TYPICAL STUDENT: 15 hours.
DESCRIPTIVE LITERATURE: None

ASTRONOMY

PROGRAM NAME: MOON
AUTHOR: E. S. Avner
DESCRIPTION: Demonstration of rough algorithm for rising and setting times of moon at different phases and seasons. Generation of increasingly refined times of rising and setting.
USE OF PROGRAM: Segment for use in astronomy courses. (UI, ASTR. 101).
PREREQUISITES: HS algebra
TIME SPENT ON PLATO BY TYPICAL STUDENT: 2 hours
DESCRIPTIVE LITERATURE: Avner, E. S., "Two Astronomy Dialogs," in "Computer Notes," ed. by D. L. Shirer, American Journal of Physics, 39, 1545 (December, 1971).

PROGRAM NAME: PLANET
AUTHOR: E. S. Avner
DESCRIPTION: Planetary motion. Introduces conic sections, effects of gravity, planetary motion with laboratory approach and simulation.
USE OF PROGRAM: Course segment in introductory astronomy. (UI, ASTR 101, 300, 306, 307).
PREREQUISITES: HS algebra
TIME SPENT ON PLATO BY TYPICAL STUDENT: 3 hours
DESCRIPTIVE LITERATURE: Avner, E. S., "Computer-Assisted Instruction in Astronomy," Journal of College Science Teaching, April (1972).

BASIC MEDICAL SCIENCE

PROGRAM NAME: PREGNANCY
AUTHOR: L. Jones
DESCRIPTION: Final examination on basic medical science involved in pregnancy.
USE OF PROGRAM: Evaluation of students at end of a year of basic medical science.
PREREQUISITES: First year in basic medical science.
TIME SPENT ON PLATO BY TYPICAL STUDENT: 6 hours
DESCRIPTIVE LITERATURE: None

BIOLOGY

PROGRAM NAME: ANIMAL GENETICS
AUTHORS: M. Grossman, D. Chirolas
DESCRIPTION: Quantitative genetics: use of selection systems in animal breeding; changes in gene frequency.
USE OF PROGRAM: Course segment for population genetics (UI, D S 415).
PREREQUISITES: upper classman or graduate standing.
TIME SPENT ON PLATO BY TYPICAL STUDENT: 2 hours
DESCRIPTIVE LITERATURE: Chirolas, D. and M. Grossman, "Computer-assisted Instruction in Teaching Population Genetics," Journal of Heredity (May-June, 1972).

PROGRAM NAME: GENERAL BIOLOGY
AUTHOR: R. Arsenty
DESCRIPTION: Material presented by PLATO used as one of a number of audio-tutorial and visual aids in introductory biology course stressing a humanistic approach to biology for liberal arts students. Covers topics such as: pollution, population, CBW, radiation biology, organ transplants, etc., in addition to conventional biological areas. Uses gaming, inquiry, tutorial and simulation teaching techniques.
USE OF PROGRAM: One of several teaching aids used in introductory biology for LAS college students. (UI, BIOL 100, 101).
PREREQUISITES: None
TIME SPENT ON PLATO BY TYPICAL STUDENT: 44 hours/semester
DESCRIPTIVE LITERATURE: Arsenty, R. P. and G. S. Kieffer, "An Evaluation of the Teaching Effectiveness of PLATO in a First Level Biology Course," CERL Report X-32 (December, 1971).
EVALUATIVE COMMENTS ON PLATO INSTRUCTION: Students overwhelmingly favored PLATO as a teaching aid over any other tutorial medium available to them in this course.

BIOLOGY (Cont.)

PROGRAM NAME: HEREDITY, EVOLUTION AND SOCIETY
AUTHORS: D. Eades, B. Hyatt, P. Tenczar
DESCRIPTION: Basic concepts of genetics and evolutionary theory and their relationship to the position of man in his environment are taught using tutorial, simulation and inquiry techniques. Topics include Mendelian genetics, Lamarkian vs. neo-Darwinian evolutionary theory, human evolution, impact of population explosion, etc.. Extensive use of computer-simulated models in genetics and evolution.
USE OF PROGRAM: Segment of CBE biology course (UI, BIOL 115 and UI, ZOO 107).
PREREQUISITES: High school biology
TIME SPENT ON PLATO BY TYPICAL STUDENT: 45 hours/semester
DESCRIPTIVE LITERATURE: Hyatt, B. W., D. C. Eades and P. Tenczar, "An Example of Computer-based Education in Biology," BioScience (June, 1972).
EVALUATIVE COMMENTS ON PLATO INSTRUCTION: PLATO used for teaching biology is an excellent medium for individualizing instruction, mastery-learning, more sensible organization of course material other than by semester, development of student's research ability through use of simulation material, and for a critical evaluation of teaching materials. Students taught by PLATO seemed to do better on examinations than similar students taught by conventional means in previous years.

BUSINESS ADMINISTRATION

PROGRAM NAME: MANAGEMENT SCIENCE
AUTHOR: C. Necco
DESCRIPTION: Introduction to L. R. methods in management science.
USE OF PROGRAM: Graduate instruction in business. (UI, B ADM 573)
PREREQUISITES: Undergraduate courses in business administration.
TIME SPENT ON PLATO BY TYPICAL STUDENT: 2 hours
DESCRIPTIVE LITERATURE: None

CHEMISTRY

PROGRAM NAME: COMMUNITY COLLEGE CHEMISTRY
AUTHOR: R. L. Bhatia
DESCRIPTION: Principles of general chemistry
USE OF PROGRAM: Course segments (City Colleges, Chicago, CHEM 106, 131)
PREREQUISITES: High School mathematics
TIME SPENT ON PLATO BY TYPICAL STUDENT: 12 hours
DESCRIPTIVE LITERATURE: None

CHEMISTRY (Cont.)

PROGRAM NAME: GENERAL CHEMISTRY

AUTHORS: R. Grandey, A. Muirhead, L. Francis

DESCRIPTION: 1) Mathematics for chemists including slide rule techniques, multiplication of fractions, conversion factors, exponential notation, graphing, algebra; 2) chemical formula and stoichiometry calculations and quiz; 3) drill in balancing oxidation-reduction equations; 4) nomenclature of ionic compounds; 5) mass spectra; 6) concentration of solutions, titration; 7) gas laws; 8) chemical kinetics; 9) inorganic qualitative analysis; 10) molecular weight determinations---Dumas method). Uses remedial branching, student generated problems, randomly selected problem generation, extensive help sequences, laboratory simulations, etc..

USE OF PROGRAM: Supplements introductory college chemistry courses (UI, CHEM 100, 101, 107, 108) (Parkland, 101-103, 201-203).

TIME SPENT ON PLATO BY TYPICAL STUDENT: 30 hours/semester

DESCRIPTIVE LITERATURE: Grandey, R., "An Investigation of the Use of Computer-Aided Instruction in Teaching Students How to Solve Selected Multistep General Chemistry Problems," CERL Report X-19 (November, 1970).

Grandey, R., "The Use of Computers to Aid Instruction in Beginning Chemistry," J. Chem. Educ., 48, 791 (December, 1971).

Francis, L., "Computer-Simulated Inorganic Qualitative Analysis," 5th Great Lakes Meeting, American Chemical Society, Peoria, Ill. (June, 1971).

EVALUATIVE COMMENTS ON PLATO INSTRUCTION: Student performances on three different types of lesson material for each of three topics showed significant and beneficial effect of PLATO instruction on student performance. Students also enjoyed the PLATO instruction.

PROGRAM NAME: MOLECULAR SYMMETRY

AUTHOR: L. Francis

DESCRIPTION: Animation and extensive graphics to help the students work through a large number of molecular symmetry problems at rates appropriate to each student.

USE OF PROGRAM: Supplement to advanced college inorganic courses (UI, 315, 406).

PREREQUISITES: College junior standing.

TIME SPENT ON PLATO BY TYPICAL STUDENT: 3 hours

DESCRIPTIVE LITERATURE: None

CHEMISTRY (Cont.)

PROGRAM NAME: ORGANIC CHEMISTRY

AUTHORS: S. G. Smith, J. Ghesquiere

DESCRIPTION: 1) Tutorial, animation, and experiment-simulation development of the chemistry of hydrocarbons, alkenes, alcohols, alkylhalides, arenes, aldehydes, and ketones; 2) Multistep aliphatic and aromatic synthesis presented through problems in which computer calculates correctness of synthesis rather than comparing the student's proposed scheme to pre-selected approach; 3) Spectroscopy, including on-line calculation of NMR spectra; 4) "Dialog" techniques used in qualitative organic analysis; 5) Laboratory simulation of distillation and crystallization with accompanying dialogue and tutorial instruction.

USE OF PROGRAM: Segments of college course (UI, CHEM 131, 136, 181, 338).

PREREQUISITES: One year chemistry.

TIME SPENT ON PLATO BY TYPICAL STUDENT: 22 hours/semester

DESCRIPTIVE LITERATURE: Smith, S. G., "The Use of Computers in the Teaching of Organic Chemistry," J. Chem. Educ., 47, 608-611 (September, 1970).

Smith, S. G., "Computer-aided Teaching of Organic Syntheses," J. Chem. Educ., 48, 727-729 (November, 1971).

PROGRAM NAME: WATER CHEMISTRY

AUTHORS: S. G. Smith, J. Ghesquiere

DESCRIPTION: Basic chemical approach to general analysis of some common ions found in natural water.

USE OF PROGRAM: Instruction, review or testing

PREREQUISITES: College freshmen or sophomores.

TIME SPENT ON PLATO BY TYPICAL STUDENT: 6 hours

DESCRIPTIVE LITERATURE: None

CHINESE

PROGRAM NAME: INTRODUCTION TO READING, WRITING, AND SPEAKING CHINESE.

AUTHOR: P. Kuo

DESCRIPTION: Lessons in sounds, pronunciation, writing, phonetics, reading, comprehension and translation of Chinese.

USE OF PROGRAM: First and second year instructional courses (UI, CHIN 201, 202, 203, 204, 301, 302). Also used in intensive summer course in Chinese.

PREREQUISITES: HS vocabulary in English.

TIME SPENT ON PLATO BY TYPICAL STUDENT: 30 hours

DESCRIPTIVE LITERATURE: None

COMMUNICATIONS

PROGRAM NAME: ALTERNATIVE FUTURES
AUTHORS: S. Umpleby, V. Lamont, W. Pearson
DESCRIPTION: Computer-based exploration of alternative futures based on occurrences of possible technological and social developments using tutorial, inquiry, gaming and simulation techniques.
USE OF PROGRAM: Course supplement (UI, POLI S 293), demonstration and research.
PREREQUISITES: High School education
TIME SPENT ON PLATO BY TYPICAL STUDENT: 1-5 hours
DESCRIPTIVE LITERATURE: Umpleby, S., "The Teaching Computer as a Gaming Laboratory," Simulation and Games, II(1), 5-25, (March, 1971).
Umpleby, S., "The Delphi Exploration: A Computer-based System for Obtaining Subjective Judgments on Alternative Futures: A Progress Report," Social Implications of Science and Technology, Report F-1, University of Illinois, CERL, (August, 1969).
Osgood, C. E. and S. Umpleby, "A Computer-based System for Exploration of Possible Futures for Mankind 2000," Jungk, R. and Galtung, J. (eds), Mankind 2000, Oslo, Norwegian University Press, 1969. Also "Efforschung der Zukunft mit Hilfe von Computern," Menschen in Jahr 2000, edited by Robert Jungk, Frankfurt an Main: Umschlau Verlag, 1969.
Umpleby, S., "The Illinois Delphi Exploration of Alternative Futures," Journal of Aesthetic Education, 4(1), (January, 1970).
Umpleby, S. and J. Briggs, "Exploring the Future with a Computer," The Futurist, (December, 1970).
Lamont, V. and S. Umpleby, "Forty 'Information Units' with Background Paragraphs for use in a Computer-based Exploration of the Future," Social Implications of Science and Technology, Report F-2, Institute of Communications Research, University of Illinois, (March, 1970).
Umpleby, S., "Citizen Sampling Simulations: A Method for Involving the Public in Social Planning," Policy Sciences, 1(3), 361 (Fall, 1970). Also edited version in German in Analysen and Prognosen, (November, 1970). Also in Radical Software, 3, (Spring, 1971).
Umpleby, S., "Structuring Information for a Computer-based Communications Medium," Fall, 1971, Joint Computer Conference of American Federation of Information Processing Societies, (November, 1971).

PROGRAM NAME: BONEYARD CREEK - A COMMUNITY ISSUE
AUTHOR: V. Lamont
DESCRIPTION: Computer acts as data collector among persons with different viewpoints on alternative solutions for solving an environmental problem in Champaign-Urbana.
USE OF PROGRAM: Demonstration & Research
PREREQUISITES: None
TIME SPENT ON PLATO BY TYPICAL STUDENT: 1 hour
DESCRIPTIVE LITERATURE: Lamont, V., "PLATO Program on Boneyard Creek," Institute of Communications Research, University of Illinois, Urbana, Illinois, (June, 1970).
Lamont, V., "A Progress Report on the Use of the Teaching Computer in Citizen Participation in Community Planning," Institute of Communications Research, University of Illinois, Urbana, Illinois (May, 1971).

COMMUNICATIONS (Cont.)

PROGRAM NAME: FUTURE OF THE UNIVERSITY
AUTHORS: S. Umpleby, V. Lamont, W. Pearson
DESCRIPTION: Computer used as mediator among groups with different viewpoints on future developments in the university.
USE OF PROGRAM: Demonstration and Research
PREREQUISITES: None
TIME SPENT ON PLATO BY TYPICAL STUDENT: 1 hour
DESCRIPTIVE LITERATURE: Lamont, V., W. Pearson, and S. Umpleby, "The Future of the University: A Progress Report," Institute of Communications Research, University of Illinois, Urbana, Illinois, (March, 1972).

COMPUTER SCIENCE

PROGRAM NAME: FORTRAN IV PROGRAMMING
AUTHOR: D. Hyde, D. Meller
DESCRIPTION: Lessons in introductory computer programming featuring student-controlled CAI and student program execution capability.
USE OF PROGRAM: Experimental segments for elementary programming course (UI COMP S 101, 199).
PREREQUISITES: Algebra and beginning calculus.
TIME SPENT ON PLATO BY TYPICAL STUDENT: 12 hours
DESCRIPTIVE LITERATURE: None

PROGRAM NAME: MOVEMAN
AUTHOR: P. Tenczar
DESCRIPTION: Introduction to computer programming for second graders using symbols and graphics.
USE OF PROGRAM: Instructional program in elementary mathematics curriculum; also used as demonstration and research program.
PREREQUISITES: None
TIME SPENT ON PLATO BY TYPICAL STUDENT: 1.5 hour
DESCRIPTIVE LITERATURE: None

PROGRAM NAME: PASSIVE LOGIC CIRCUITS
AUTHOR: D. Meller
DESCRIPTION: Basics necessary to learn translation of Boolean expression to logic circuit and vice versa using AND, OR, NOT, NAND and NOR gates.
USE OF PROGRAM: Instructional and research program.
PREREQUISITES: Algebra and first year college courses.
TIME SPENT ON PLATO BY TYPICAL STUDENT: 40 min.
DESCRIPTIVE LITERATURE: None
EVALUATIVE COMMENTS ON PLATO INSTRUCTION: College sophomores (N=22), pretest average = 17%, posttest = 86%, after two week delay, posttest = 83%.

DEMOGRAPHY

PROGRAM NAME: POPULATION DYNAMICS

AUTHORS: P. Handler, J. Sherwood, G. Polin

DESCRIPTION: Using inquiry and simulation techniques, the investigator can obtain population projections for any country or state. Demographic variables may be changed immediately or as a function of time to illustrate the effect of various rates of growth on economic development.

USE OF PROGRAM: Instructional demonstration for college or high school courses or research (UI, SOC 270 et al.)

PREREQUISITES: None

TIME SPENT ON PLATO BY TYPICAL STUDENT: 5-12 hours

DESCRIPTIVE LITERATURE: Handler, P. and J. Sherwood, "The PLATO System Population Dynamics Workbook," (1971).

ECONOMICS

PROGRAM NAME: ECONOMY WITHOUT GOVERNMENT

AUTHORS: E. Moyer, D. Paden

DESCRIPTION: Review of static macro economic model of an economy without government.

USE OF PROGRAM: Segment of college course (UI, ECON 108)

PREREQUISITES: 9 weeks of UI ECON 108

TIME SPENT ON PLATO BY TYPICAL STUDENT: 1 hour

DESCRIPTIVE LITERATURE: None

EDUCATION

PROGRAM NAME: CAI DEMONSTRATION FOR SECONDARY EDUCATION

AUTHOR: J. R. Ghesquiere, B. L. Hicks

DESCRIPTION: Introduces secondary education student to use of CAI in the classroom. Clarifies classroom teacher's position with respect to CAI author and students who use the lesson.

USE OF PROGRAM: Demonstration program used by students in UI, SEC ED 357.

PREREQUISITES: Senior or graduate level in education or computer science.

TIME SPENT ON PLATO BY TYPICAL STUDENT: 5 hours.

DESCRIPTIVE LITERATURE: None

PROGRAM NAME: DIGRAPHS AND BRANCHING MATRICES

AUTHORS: D. L. Hyde, B. L. Hicks

DESCRIPTION: Application of linear graphs to education, displaying digraphs up to 8 nodes and branching matrices.

USE OF PROGRAM: Demonstration in secondary education and computer science.

PREREQUISITES: Some knowledge of graph theory

TIME SPENT ON PLATO BY TYPICAL STUDENT: 1 hour

DESCRIPTIVE LITERATURE: Paper for UI, SEC ED 357 by D. L. Hyde and M. Donovan.

EDUCATION (Cont.)

PROGRAM NAME: GENERAL EDUCATION DIPLOMA (GED)
AUTHOR: E. Magidson
DESCRIPTION: Instruction in basics of English and mathematics
USE OF PROGRAM: General education diploma (GED) instruction---high
school equivalency.
PREREQUISITES: Some high school work.
TIME SPENT ON PLATO BY TYPICAL STUDENT: 8 hours
DESCRIPTIVE LITERATURE: None

PROGRAM NAME: STUDENT PATHS IN CAI LESSONS
AUTHORS: B. L. Hicks and D. V. Meller
DESCRIPTION: The one-dimensional matrix of student state is entered by
state nodal path. Program plots path of the student on a branching
matrix graph.
USE OF PROGRAM: Research for instructional authors
PREREQUISITES: None
TIME SPENT ON PLATO BY TYPICAL STUDENT: Does not pertain
DESCRIPTIVE LITERATURE: None

PROGRAM NAME: TEACHING STRATEGIES AND EVALUATION STATISTICS
AUTHOR: K. Travers
DESCRIPTION: Simulated teaching strategies and evaluation with illustrations
from high school mathematics.
USE OF PROGRAM: Demonstrations for secondary education student mathematics
teachers (UI, SEC ED 356).
PREREQUISITES: College junior standing.
TIME SPENT ON PLATO BY TYPICAL STUDENT: 2 hours
DESCRIPTIVE LITERATURE: None

EDUCATIONAL AND INSTRUCTIONAL RESEARCH

PROGRAM NAME: VERBAL LEARNING

AUTHORS: W. Montague, C. E. Webber, A. Wearing, C. B. Walker

DESCRIPTION: General research program involving verbal learning experiments on many subjects.

USE OF PROGRAM: Research (not presently in use)

PREREQUISITES: None

TIME SPENT ON PLATO BY TYPICAL STUDENT: Not applicable

DESCRIPTIVE LITERATURE: Webber, C. E. and W. E. Montague, "PAVLEW: A Program for Verbal Learning Experiments on the PLATO System," CSL Report I-135 (1966).

Webber, C. E. and W. E. Montague, "The Effect of Complexity of Natural Language Mediators and the Associability of Pairs on Paired Associate Learning," CSL Report R-333, (1967).

Webber, C. E. and W. E. Montague, "Natural Language Mediation: A Source of Interference with Extra-Experimental Interference," Psychonomic Science, 9(6), 317-18, (1967).

Webber, C. E. and W. E. Montague, "The Complexity of Natural Language Mediators and its Relation to Paired-Associate Learning," Psychonomic Science, 7(4), 135-36, (1967).

Webber, C. E. and W. E. Montague, "Associability of CVC-word Pairs and Its Relation to List Difficulty," Psychonomic Science, 7(4), 133-34, (1967).

Webber, C. E. and W. E. Montague, "The Retention of Responses to Individual Stimuli and Stimulus Classes," Psychonomic Science, 9(2), 81-82, (1967).

PROGRAM NAME: INSTRUCTIONAL PARAMETERS IN PROGRAMMED LEARNING

AUTHORS: R. Anderson, T. Andre, R. Kulhavy

DESCRIPTION: PLATO used to present material and collect data in some basic research studies exploring instructional parameters in programmed learning.

USE OF PROGRAM: Research (not presently in use)

PREREQUISITES: Not applicable

TIME SPENT ON PLATO BY TYPICAL STUDENT: Not applicable

DESCRIPTIVE LITERATURE: Anderson, R. C., R. W. Kulhavy, T. Andre, "Feedback Procedures in Programmed Instruction," J. Educ. Psych., 62, 148-156 (1971); also appears as CERL Report X-11 (February, 1970).

Andre, T., R. C. Anderson, and G. H. Watts, "List Organization and Retroactive Inhibition in Free Recall," CERL Report X-24 (June, 1971).

EDUCATIONAL AND INSTRUCTIONAL RESEARCH (Cont.)

PROGRAM NAME: PROCTOR
AUTHOR: R. A. Avner
DESCRIPTION: Executive for "Math for Primary Grades," Permits on-line monitoring and control of class. Collects, analyzes, and displays student and lesson data for evaluation of student performance and formative evaluation of lesson material. Displays may be tabular or graphic, on-line (soft copy) or printed (hard copy). (See also STATISTICS: Program COMPUTE).
USE OF PROGRAM: Student data evaluation
PREREQUISITES: Not applicable
TIME SPENT ON PLATO BY TYPICAL STUDENT: Not applicable
DESCRIPTIVE LITERATURE: None

PROGRAM NAME: SIMULATED TESTING
AUTHOR: L. Steinkellner
DESCRIPTION: Simulated high school algebra class test construction with resultant data and item by item analysis of scores. Designed for application to student teaching methods.
USE OF PROGRAM: Student teacher instruction (UI, Ed 241).
PREREQUISITES: Introduction to use of test scores
TIME SPENT ON PLATO BY TYPICAL STUDENT: 2 hours
DESCRIPTIVE LITERATURE: Steinkellner, L., "A Computer Simulation to Teach Test Construction," CERL Report X-24 (June, 1971).

ENGINEERING - AERONAUTICAL

PROGRAM NAME: AERONAUTICAL STRUCTURES AND SOLID MECHANICS
AUTHOR: J. Bennett
DESCRIPTION: Beam theory and calculations of shear, moments. roids, stress, etc..
USE OF PROGRAM: Segments for course in flight structures. (UI, AAE 224).
PREREQUISITES: Statics
TIME SPENT ON PLATO BY TYPICAL STUDENT: 6 hours
DESCRIPTIVE LITERATURE: None

ENGINEERING - CIVIL

PROGRAM NAME: STRUCTURAL ANALYSIS OF BEAMS
AUTHOR: S. Fenves
DESCRIPTION: On-line design and analysis of structures such as continuous beams.
USE OF PROGRAM: Course segment (UI, CE 261) (Not presently in use)
PREREQUISITES: Mechanical Engineering prerequisites
TIME SPENT ON PLATO BY TYPICAL STUDENT: 3 hours
DESCRIPTIVE LITERATURE: None

ENGINEERING - ELECTRICAL

PROGRAM NAME: COMPUTER-GUIDED EXPERIMENTATION

AUTHOR: J. P. Neal et al.

DESCRIPTION: Self-teaching electrical engineering laboratory experimentation which receives programmed guidance automatically actuated within the CAI system through an electrical interface with special sensors that report each student's successive instrument adjustments and terminal interconnections.

USE OF PROGRAM: Introduction to electrical engineering laboratory (UI, EE CGE).

PREREQUISITES: freshmen engineering prerequisites

TIME SPENT ON PLATO BY TYPICAL STUDENT: 25 hours/student

DESCRIPTIVE LITERATURE: Neal, J. P., "The STEEL Program for Computer-Guided Experimentation," Cosine Committee of Commission on Education of The National Academy of Engineering (December, 1969).

Neal, J. P., and D. V. Meller, "Computer-Guided Experimentation - A New System for Laboratory Instruction," Purdue 1971 Symposium on Applications of Computers to Electrical Engineering Education, Purdue University, Lafayette, Indiana (April, 1971); also appears as CERL Report X-30 (July, 1971).

Neal, J. P., and D. V. Meller, "Computer-Guided Experimentation," IEEE Transactions on Education (August, 1972).

PROGRAM NAME: ELECTRICAL NETWORKS

AUTHOR: R. Grossel

DESCRIPTION: Circuit theory lessons use tutorial, drill-and-practice, and simulation techniques, and include: Kirchoff's laws and their applications, simple resistive networks, and steady-state RLC networks (using an on-line interactive network analyzer) allowing analysis of natural response of a parallel RLC network and simulation as well as complete solutions of first and second order dynamic networks.

USE OF PROGRAM: Course Supplements (UI, EE 260).

PREREQUISITES: Soph. level Elec. Engr.

TIME SPENT ON PLATO BY TYPICAL STUDENT: 14 hours/semester

DESCRIPTIVE LITERATURE: Grossel, R., "Teaching Electrical Networks with a Computer-based Education System," CERL Report X-29 (June, 1971).

EVALUATIVE COMMENTS ON PLATO INSTRUCTION: The students enjoyed working alone ("I'm not embarrassed by my stupid mistakes") and at their own pace. They enjoyed active participation ("There's no way to sit back and do nothing as in a lecture.") and the instant feedback (I like the immediate correction or affirmation of my answers."). In the discussion sessions which followed the PLATO sessions, the instructor found that the student participation was more active and that the discussions were at a higher level than in a conventionally taught class on the same subject.

ENGINEERING - ELECTRICAL (Cont.)

PROGRAM NAME: INQUIRY IN NETWORK ANALYSIS

AUTHOR: R. L. Johnson

DESCRIPTION: Inquiry techniques used to teach electrical engineering network analysis.

USE OF PROGRAM: Course Supplement (UI, EE 322) (not now in use)

PREREQUISITES: Soph. level Elec. Engr.

TIME SPENT ON PLATO BY TYPICAL STUDENT: 6 hours

DESCRIPTIVE LITERATURE: Johnson, R. L., "The Use of Programmed Learning and Computer-based Instruction Techniques to Teach Electrical Engineering Network Analysis," CSL Report R-297 (July, 1966).

Johnson, R. L., "Using the PLATO Teaching System for Computer-based Instruction in Electrical Engineering," Int'l. J. Elec. Eng. Educ., 5, 31-39 (1967).

EVALUATIVE COMMENTS ON PLATO INSTRUCTION: Inquiry logic seems effective and has some advantages over tutorial logic, but combination of both would be desirable. Students preferred active participation in CAI instruction over conventional classroom type instruction.

PROGRAM NAME: NETWORK ANALYSIS

AUTHORS: D. L. Bitzer, R. L. Johnson, S. Chan, M. Walker

DESCRIPTION: Tutorial presentation of material in electrical engineering network analysis. These lessons constitute the first PLATO lessons extensively used in an accredited course.

USE OF PROGRAM: Supplementary material for UI EE 322 (not presently in use)

PREREQUISITES: Soph. level electrical engineering

TIME SPENT ON PLATO BY TYPICAL STUDENT: 14 hours/semester

DESCRIPTIVE LITERATURE: None

ENGINEERING - THEORETICAL AND APPLIED MECHANICS

PROGRAM NAME: STATICS

AUTHOR: T. M. Elsesser

DESCRIPTION: Studies of forces acting upon bodies such as simple structures, trusses and frames, with and without friction.

USE OF PROGRAM: Supplements the course. Used for problem-solving work periods. (UI, TAM 150).

PREREQUISITES: Integral Calculus

TIME SPENT ON PLATO BY TYPICAL STUDENT: 17 hours/semester

DESCRIPTIVE LITERATURE: None

ENGLISH

PROGRAM NAME: ENGLISH AS A SECOND LANGUAGE
AUTHORS: R. Stock, G. Dowling, B. Raither
DESCRIPTION: Rapid review of English grammar.
USE OF PROGRAM: Remedial English for foreign students.
PREREQUISITES: Some knowledge of the English language.
TIME SPENT ON PLATO BY TYPICAL STUDENT: 20 hours
DESCRIPTIVE LITERATURE: None
EVALUATIVE COMMENTS ON PLATO INSTRUCTION: Students are very enthusiastic about instruction via PLATO.

PROGRAM NAME: ENGLISH DRILL
AUTHOR: B. Geaither
DESCRIPTION: Instruction and drills in English grammar, vocabulary usage, and punctuation rules.
USE OF PROGRAM: Community College English review courses.
PREREQUISITES: Some knowledge of basic language skills and sentence structure.
TIME SPENT ON PLATO BY TYPICAL STUDENT: 12 hours
DESCRIPTIVE LITERATURE: None

FOREIGN LANGUAGES - GENERAL

PROGRAM NAME: SENTENCE GENERATION
AUTHORS: M. K. Myers, R. Ariew, A. Armengol et al.
DESCRIPTION: Sentence generation exercises relying largely on non-verbal clues: pictorial representation of verbal concept and symbolic representation of grammatical categories. Series of lessons exist for French, Spanish, English, German, Russian, Italian.
USE OF PROGRAM: Introductory lessons in any of the given languages.
PREREQUISITES: None
TIME SPENT ON PLATO BY TYPICAL STUDENT: 18 hours
DESCRIPTIVE LITERATURE: Myers, M. K. and R. A. Ariew, "Sentence Generation via Classroom and PLATO," Proc. 2nd National Conference on Visual Literacy, Chicago, Illinois (April, 1970).
Myers, M. K. and R. A. Ariew, "A New Type of CAI Foreign Language Lesson - Sentence Generation through Visual Cues," Conference on Computers in the Undergraduate Curricula, Proceedings, Iowa City, Iowa, (September, 1970).

FRENCH

PROGRAM NAME: ELEMENTARY AND INTERMEDIATE FOUNDATION COURSE

AUTHORS: M. K. Myers, R. Ariew et al.

DESCRIPTION: Drill-and-practice and tutorial approach to teach audio comprehension and writing skills in French. Includes special drills, tests and examinations. Is adaptation of materials by F. Marty.

USE OF PROGRAM: "Laboratory" for four semester foundation course (UI, FR 101-104).

PREREQUISITES: None

TIME SPENT ON PLATO BY TYPICAL STUDENT: 168 hours (42 hours/semester)

DESCRIPTIVE LITERATURE: Myers, M. K., "Platonic Pubescence or Main Gain of the Computer - Tutor," paper, N. Y. Conference on Teaching and Learning of Modern Languages, Albany, New York (February, 1970).

Myers, M. K. and J. B. Gilpin, "PLATO: The Teacher's Mentor, Dialogues with a Computer," New York State Federation of Foreign Teachers' Bulletin, 21(3), (April, 1970).

Myers, M. K., "Platonic Pubescence: The Instructional Computer Comes of Age," Newsletter of National Association of Language Laboratory Directors, IV(IV), 52-62 (May, 1970).

Myers, M. K., "Media in Systems," Modern Language Journal, (September, 1970).

EVALUATIVE COMMENTS ON PLATO INSTRUCTION: Teaching by PLATO gives an opportunity to optimize the individualization of the instruction.

PROGRAM NAME: PHONETICS

AUTHORS: M. K. Myers, R. Ariew et al.

DESCRIPTION: Uses tutorial, drill-and-practice, and dialogue techniques to teach students the French phonetic system. Exercises include transcriptions using IPA symbols of French textual material. Inquiry techniques insure student understanding of phonetic terminology.

USE OF PROGRAM: "Laboratory" for phonetics French course (UI, FR 313)

PREREQUISITES: Junior or graduate standing

TIME SPENT ON PLATO BY TYPICAL STUDENT: 55 hours/semester

DESCRIPTIVE LITERATURE: None

EVALUATIVE COMMENTS ON PLATO INSTRUCTION: Teaching by PLATO allows optimization of individual instruction.

LATIN

PROGRAM NAME: BEGINNING LATIN (A)
AUTHOR: R. T. Scanlan
DESCRIPTION: Beginning Latin taught by a traditional grammar and syntax approach.
USE OF PROGRAM: Course Supplement (UI, LAT 101, 102).
PREREQUISITES: None
TIME SPENT ON PLATO BY TYPICAL STUDENT: 80 hours
DESCRIPTIVE LITERATURE: Scanlan, R. T., "Computer-assisted Instruction in the Humanities," Ill. J. of Educ., 33-36, (February, 1970).
Scanlan, R. T., "Computer-assisted Instruction in Latin," Classical Journal, 66(3), 223-227 (February-March, 1971).
Scanlan, R. T., "Computer-assisted Instruction: PLATO in Latin," Foreign Language Annals, 5-1, 84-89, (October, 1971).
EVALUATIVE COMMENTS ON PLATO INSTRUCTION: The students enjoyed competing with the computer as evidenced by a 50% increase in reading comprehension speed when timed reading sections with related questions were used. Students were able to cover more material when using PLATO; those in the PLATO group did 1-1/2 times the number of problems in the semester as did those in the classroom instruction. Students also voluntarily chose to repeat computer lessons in order to increase their proficiency with a consequent 2/3 increase in rapidity of performance and 2/3 decrease in error rate. Although the study of Latin using PLATO was a voluntary program, there was a 95% participation in it with reasons given such as "the computer program clarifies and reinforces the learning," or the "computer was kind".

PROGRAM NAME: BEGINNING LATIN (B)
AUTHOR: R. T. Scanlan
DESCRIPTION: Introductory Latin which teaches the language through the techniques of structural linguistics.
USE OF PROGRAM: Course Supplement (UI, LAT 101, 102)
PREREQUISITES: None
TIME SPENT ON PLATO BY TYPICAL STUDENT: 45 hours
DESCRIPTIVE LITERATURE: Scanlan, R. T., "Computer-assisted Instruction in the Humanities," Illinois Journal of Education, 33-36, (February, 1970)
Scanlan, R. T., "Computer-assisted Instruction in Latin," Classical Journal, 66(3), 223-227, (February-March, 1971).
Scanlan, R. T., "Computer-assisted Instruction: PLATO in Latin," Foreign Language Annals, 5-1, 84-89 (October, 1971).
EVALUATIVE COMMENTS ON PLATO INSTRUCTION: (See comments under Beginning Latin (A)).

LATIN (Cont.)

PROGRAM NAME: LATIN COMPOSITION
AUTHOR: R. T. Scanlan
DESCRIPTION: Tutorial and drill approach teaching effective expression in written Latin.
USE OF PROGRAM: Course Supplement (UI, LAT 113, 114)
PREREQUISITES: 2 years high school Latin, 2 semesters college Latin
TIME SPENT ON PLATO BY TYPICAL STUDENT: 45 hours
DESCRIPTIVE LITERATURE: Scanlan, R. T., "Computer-assisted Instruction in the Humanities," Illinois Journal of Education, 33-36, (February, 1970).
Scanlan, R. T., "Computer-assisted Instruction in Latin," Classical Journal, 66(3), 223-227, (February-March, 1971).
Scanlan, R. T., "Computer-assisted Instruction: PLATO in Latin," Foreign Language Annals, 5-1, 84-94 (October, 1971).
EVALUATIVE COMMENTS ON PLATO INSTRUCTION: (See comments under Beginning Latin (A)).

PROGRAM NAME: VERGIL'S AENEID
AUTHOR: R. T. Scanlan
DESCRIPTION: Tutorial verification of surface comprehension of books 1, 2, 4 and 6 of Vergil's Aeneid.
USE OF PROGRAM: Course Supplement (UI, LAT 306).
PREREQUISITES: 3 years high school Latin, 3 semesters college Latin
TIME SPENT ON PLATO BY TYPICAL STUDENT: 45 hours
DESCRIPTIVE LITERATURE: Scanlan, R. T., "Computer-assisted Instruction in the Humanities," Ill. Journal of Education, 33-36, (February, 1970).
Scanlan, R. T., "Computer-assisted Instruction in Latin," Classical Journal, 66(3), 223-227, (February-March, 1971).
Scanlan, R. T., "Computer-assisted Instruction: PLATO in Latin," Foreign Language Annals, 5-1, 84-89 (October, 1971).
EVALUATIVE COMMENTS ON PLATO INSTRUCTION: (See comments under Beginning Latin (A)).

LIBRARY SCIENCE

PROGRAM NAME: USE OF LIBRARY
AUTHOR: M. Axeen
DESCRIPTION: Tutorial instruction in use of a library including history of books, printing, and libraries, description of Dewey Decimal system, and instructions in use of card catalogues, files, dictionaries, etc..
USE OF PROGRAM: CBE course (UI, LIB S 195), no conventional classroom instruction (not presently in use).
PREREQUISITES: None
TIME SPENT ON PLATO BY TYPICAL STUDENT: 28 hours
DESCRIPTIVE LITERATURE: Axeen, M., "Teaching the Use of the Library to Undergraduates: An Experimental Comparison of Computer-based Instruction and the Conventional Lecture Method," CSL Report R-361 (1967).
EVALUATIVE COMMENTS ON PLATO INSTRUCTION: Undergraduate students learned as well through the CBE course as they did through the conventional lecture method. The CBE course covered the material in less time than the conventional classroom course. Teacher preparation time was much more extensive than for the classroom lectures. PLATO instruction required less teaching assistance than the conventional lecture method.

LINGUISTICS

PROGRAM NAME: TRANSFORMATIONAL GRAMMAR
AUTHORS: R. Wilbur, S. Quigley, S. Moreno, M. Rosenberg
DESCRIPTION: Basic course in transformational grammar.
USE OF PROGRAM: Instruction for teachers in deaf education. Can be applied to other related disciplines.
PREREQUISITES: Junior level
TIME SPENT ON PLATO BY TYPICAL STUDENT: 12 hours
DESCRIPTIVE LITERATURE: None

MATHEMATICS

PROGRAM NAME: ALGEBRA
AUTHOR: R. Dillon
DESCRIPTION: Introductory algebra lessons for college students with weak mathematical backgrounds providing special demonstrations and drills for concept of number line and signed numbers.
USE OF PROGRAM: Course segment (not presently in use) (Parkland, MATH 90)
PREREQUISITES: Arithmetic
TIME SPENT ON PLATO BY TYPICAL STUDENT: 6 hours
DESCRIPTIVE LITERATURE: None

PROGRAM NAME: ARITHMETIC DRILL
AUTHORS: J. Gilpin, B. Wilson
DESCRIPTION: Arithmetic drill sequences for low achievers from sixth and seventh grades.
USE OF PROGRAM: Supplement to regular classroom work. (not presently in use)
PREREQUISITES: Elementary mathematics
TIME SPENT ON PLATO BY TYPICAL STUDENT: 3 hours
DESCRIPTIVE LITERATURE: None

PROGRAM NAME: ARRAYS
AUTHORS: J. Easley, A. Nishida
DESCRIPTION: Tutorial instruction in arrays of symbols for fourth graders.
USE OF PROGRAM: Course segment (not presently used)
PREREQUISITES: 3rd grade arithmetic
TIME SPENT ON PLATO BY TYPICAL STUDENT: 4 hours
DESCRIPTIVE LITERATURE: None

PROGRAM NAME: CALCULUS
AUTHOR: M. Cahill
DESCRIPTION: Introduction to vectors for college students
USE OF PROGRAM: College course segment
PREREQUISITES: Algebra prerequisites
TIME SPENT ON PLATO BY TYPICAL STUDENT: 2 hours
DESCRIPTIVE LITERATURE: None

MATHEMATICS (Cont.)

PROGRAM NAME: DECIMALS
AUTHORS: A. Rothbart, P. Braunfeld
DESCRIPTION: A tutorial non-fraction approach to decimals for sixth graders.
USE OF PROGRAM: Course segment (not presently in use)
PREREQUISITES: 5th grade mathematics
TIME SPENT ON PLATO BY TYPICAL STUDENT: 1-1/2 hours
DESCRIPTIVE LITERATURE: None

PROGRAM NAME: DISTRIBUTIVE PROPERTIES
AUTHORS: A. Rothbart, D. Lund
DESCRIPTION: Tutorial technique presents distributive property and short-cut methods for its use.
USE OF PROGRAM: Course segment (not presently in use)
PREREQUISITES: 4th grade arithmetic
TIME SPENT ON PLATO BY TYPICAL STUDENT: 3 hours
DESCRIPTIVE LITERATURE: None

PROGRAM NAME: GEOMETRY
AUTHOR: R. Dennis
DESCRIPTION: Tutorial instruction in informal geometry presenting material on symmetry properties of triangles and quadrilaterals and their use in discovering standard Euclidean properties of triangles and quadrilaterals.
USE OF PROGRAM: Course segment (not presently in use)
PREREQUISITES: Algebra
TIME SPENT ON PLATO BY TYPICAL STUDENT: 10 hours
DESCRIPTIVE LITERATURE: Dennis, R., "Teaching Selected Geometry Topics via a Computer System," CERL Report X-3 (June, 1968) and CERL Report X-3a (June, 1969).
Dennis, J. R., "Geometry via PLATO," The Instructor, 116 (November, 1968).
Dennis, J. R., "Informal Geometry through Symmetry," The Arithmetic Teacher, 433-436 (October, 1969).
EVALUATIVE COMMENTS ON PLATO INSTRUCTION: The program demonstrates that a computer system can control exercises requiring pictorial responses by students as well as verbal and numerical responses. A picture drawing process is easy for students to learn. The PLATO system is capable of assuming much of the routine presentation of geometry material, accomodates unusual instructional features such as pictorial responses and tracing experiments, and eliminates much of the waste time experienced by students in teacher controlled classes.

PROGRAM NAME: MATHEMATICS FOR INTERMEDIATE GRADES
AUTHOR: R. Dennis
DESCRIPTION: Drill and games in division and informal geometry instruction for fifth and sixth grades.
USE OF PROGRAM: Course supplement, 5th and 6th grades
PREREQUISITES: 4th grade arithmetic
TIME SPENT ON PLATO BY TYPICAL STUDENT: 10 hours
DESCRIPTIVE LITERATURE: None

MATHEMATICS (Cont.)

PROGRAM NAME: MATHEMATICS FOR PRIMARY GRADES

AUTHOR: E. Steinberg

DESCRIPTION: Computation, numeration, place-value, relations and problem-solving strategies using tutorial, games, and dialogue approaches designed for second and third graders. Also includes standard and non-standard drills, and placement tests.

USE OF PROGRAM: Supplementary instruction in 2nd and 3rd grade arithmetic

PREREQUISITES: 1st grade reading skills

TIME SPENT ON PLATO BY TYPICAL STUDENT: 24 hours (in 15-20 minute sessions)

DESCRIPTIVE LITERATURE: Steinberg, E. and A. Rothbart, "Some Observations of Children's Reactions to CAI," Arithmetic Teacher, 19-21, (January, 1971).

EVALUATIVE COMMENTS ON PLATO INSTRUCTION: All students were very enthusiastic as evidenced by their behavior as well as long attention span. They enjoyed repeating some of the games again and again. The slowest students seemed to be making gains in skills; others liked the challenge of the strategy activities.

PROGRAM NAME: PRE-ALGEBRA

AUTHOR: B. F. Lathan

DESCRIPTION: Fundamentals of mathematics. Mastery in manipulation of numbers, measuring units, polynomial expressions, extensive diagnosis of student answers.

USE OF PROGRAM: Community college mathematics course.

PREREQUISITES: General High School mathematics.

TIME SPENT ON PLATO BY TYPICAL STUDENT: 10 hours

DESCRIPTIVE LITERATURE: None

PROGRAM NAME: PRE-ALGEBRA

AUTHOR: M. Yamada

DESCRIPTION: Exercises in graphing, linear equations, simultaneous equations, prime factorization, exponentials, equations with fractions including word problem skills.

USE OF PROGRAM: Community College mathematics course.

PREREQUISITES: Arithmetic computation skills. General High School mathematics.

TIME SPENT ON PLATO BY TYPICAL STUDENT: 12 hours

DESCRIPTIVE LITERATURE: None

MATHEMATICS (Cont.)

PROGRAM NAME: PROOF
AUTHORS: J. A. Easley, H. M. Gelder, W. M. Golden
DESCRIPTION: Inquiry method presentation allowing proofs of mathematical theorems judged only for violations of logic. Students may develop lemmas and use them in the proofs.
USE OF PROGRAM: Course Supplements (not now in use)
PREREQUISITES: None
TIME SPENT ON PLATO BY TYPICAL STUDENT: 6 hours
DESCRIPTIVE LITERATURE: Easley, J. S., H. M. Gelder, W. Golden, "A PLATO Program for Instruction and Data Collection in Mathematical Problem Solving," CSL Report R-185 (1964).

PROGRAM NAME: SEQUENCES
AUTHORS: J. A. Easley, W. Golden
DESCRIPTION: Tutorial lessons on recursive definitions for high school students.
USE OF PROGRAM: Course segment (not presently in use)
PREREQUISITES: None
TIME SPENT ON PLATO BY TYPICAL STUDENT: 9 hours
DESCRIPTIVE LITERATURE: None

MUSIC

PROGRAM NAME: RHYTHM
AUTHOR: R. Placek
DESCRIPTION: Selected perception behaviors in rhythm. Uses random access audio device.
USE OF PROGRAM: Course segment for Basic Music for Elementary Teachers. (UI, MUSIC 240).
PREREQUISITES: None
TIME SPENT ON PLATO BY TYPICAL STUDENT: 3 hours
DESCRIPTIVE LITERATURE: None

NURSING

PROGRAM NAME: MATERNITY NURSING

AUTHORS: M. Bitzer, M. Boudreaux, E. Lyman

DESCRIPTION: Inquiry training and tutorial techniques covering material for a 12-unit course in maternity nursing including prenatal and postnatal care, labor and delivery, normal and abnormal conditions.

USE OF PROGRAM: Course supplements for maternity nursing for 2 year diploma curriculums (Mercy Hospital School of Nursing) (Parkland, NURS 103)

PREREQUISITES: High School

TIME SPENT ON PLATO BY TYPICAL STUDENT: 20 hours

DESCRIPTIVE LITERATURE: Bitzer, M. and M. Boudreaux, "Using a Computer to Teach Nursing," Nursing Forum, 8(3), 1969.

EVALUATIVE COMMENTS ON PLATO INSTRUCTION: Post-test scores on 120 students studying maternity nursing using PLATO showed significant gains by all students; and comparison of final examination grades of a control and an experimental group did not indicate a significant difference between one or two groups. The PLATO group covered the material in a maximum time of 50 hours compared to 84 hours spent in the classroom by each of the control students. The PLATO-taught students, therefore, learned the same amount of material in from 1/3 to 1/2 the time required in the conventionally-taught classroom. Student reactions vary, but students' responses seem to increase positively with the amount of exposure to the system.

PROGRAM NAME: PHARMACOLOGY FOR NURSES

AUTHORS: M. Bitzer, M. Boudreaux, E. Lyman

DESCRIPTION: Mathematics of drugs and solutions, drug therapy, and drug classification taught by use of inquiry and simulation techniques, as well as drill to insure proficiency in application of information.

USE OF PROGRAM: Course supplements in pharmacology for nurses in 2 year diploma curriculum (Parkland, NURS 102, 202).

TIME SPENT ON PLATO BY TYPICAL STUDENT: 18 hours

DESCRIPTIVE LITERATURE: None

PHYSICS

PROGRAM NAME: EXPERIMENT

AUTHORS: D. L. Bitzer, F. Propst, M. Walker

DESCRIPTION: Program which controls real-time on-line experiments in secondary emission surface physics study with immediate analysis of experimental data and display of analysis to PLATO user.

USE OF PROGRAM: Research (not presently in use)

PREREQUISITES: None

TIME SPENT ON PLATO BY TYPICAL STUDENT: Not applicable

DESCRIPTIVE LITERATURE: None

PHYSICS (Cont.)

PROGRAM NAME: INTRODUCTORY CLASSICAL MECHANICS

AUTHORS: B. Sherwood, C. Bennett, C. Tenczar

DESCRIPTION: A set of lessons used in teaching introductory college level classical mechanics for science and engineering students. Tutorial, simulation, and computational techniques are employed. Some lessons contain mastery quizzes. The lessons are heavily oriented to a graphical display terminal.

USE OF PROGRAM: CBE course (with classroom discussion) (UI, PHYCS 106)

PREREQUISITES: Calculus (concurrently)

TIME SPENT ON PLATO BY TYPICAL STUDENT: 20 hours

DESCRIPTIVE LITERATURE: Bitzer, D., R. Blomme, B. Sherwood, P. Tenczar, "The PLATO System and Science Education," Proceedings of Conference on Computers in Undergraduate Science Education, Illinois Institute of Technology, (August, 1970).

B. Sherwood, "Free-body Diagrams (A PLATO Lesson)," American Journal of Physics, 39(10), 1199-1202(1971).

B. Sherwood, C. Bennett, C. J. Mitchell, and C. Tenczar, "Experience with a PLATO Mechanics Course," Proceedings of the Conference on Computers in the Undergraduate Curricula, Dartmouth College (June, 1971).

EVALUATIVE COMMENTS ON PLATO INSTRUCTION: Classroom discussions seem of "higher level" than the usual classroom discussions in college classical mechanics courses.

PROGRAM NAME: QUANTUM MECHANICS

AUTHOR: C. Bennett

DESCRIPTION: Simulation, computational and graphical techniques used to supplement course work in Junior-Senior level Quantum Mechanics.

USE OF PROGRAM: Course supplement (UI, PHYCS 385, 386).

PREREQUISITES: Calculus, classical mechanics

TIME SPENT ON PLATO BY TYPICAL STUDENT: 10 hours

DESCRIPTIVE LITERATURE: Bennett, C. D., "Computer-based Education Lessons for Undergraduate Quantum Mechanics," paper, Conference on Computers in Undergraduate Curricula, Atlanta, Georgia, (June, 1972).

PROGRAM NAME: RESPONSIVE ENVIRONMENT PROGRAMMED LABORATORY

AUTHORS: J. R. Suchman, S. Carlson, M. Fass, C. Latta, E. Lyman

DESCRIPTION: Scientific inquiry lesson based on properties of bimetal strip designed for multi-dimensional analysis of the inquiry process. Auxiliary film used to illustrate bimetal strip experiment.

USE OF PROGRAM: Research (not presently in use)

PREREQUISITES: Elementary school science

TIME SPENT ON PLATO BY TYPICAL STUDENT: 1 hour

DESCRIPTIVE LITERATURE: Suchman, J. R. and S. Carlson, "Science Concept Development in the Elementary School through Inquiry Training," U. S. Dept. of Health, Education, and Welfare, (1966).

Bitzer, D., E. Lyman, and J. R. Suchman, "REPLAB, a Study in Scientific Inquiry Using the PLATO System," CSL Report R-260 (December, 1965).

POLITICAL SCIENCE

PROGRAM NAME: POLITICAL PROCESS INQUIRY
AUTHORS: F. Coombs, J. Zeis, J. Peters
DESCRIPTION: Inquiry, gaming and simulation used to introduce students to various aspects of the political process. Among models explored are budget-making, electioneering, presidential decision-making, union organization and coalition formation, and congressional committee process.
USE OF PROGRAM: Course supplements in introductory political science (UI, POLI S 150).
PREREQUISITES: Freshman standing
TIME SPENT ON PLATO BY TYPICAL STUDENT: 18 hours
DESCRIPTIVE LITERATURE: Coombs, F., "Innovation in Political Education: An Experiment in Computer-based Inquiry," Report to the Esso Foundation, (1971).
Coombs, F. and J. Peters, "PLATO and the Teaching of Political Science," National Gaming Council, 10th Annual Symposium (October, 1971).
EVALUATIVE COMMENTS ON PLATO INSTRUCTION: When the one hundred twenty-five students who had taken the PLATO political science instruction were asked whether they would participate in PLATO instruction again if given the chance, 91% replied affirmatively.

PSYCHOLOGY

PROGRAM NAME: ANIMAL LABORATORY
AUTHOR: A. Avner
DESCRIPTION: Simulated laboratory allowing student unlimited experimentation with operant conditioning techniques. Model observed in form of simulated animal, or as a cumulative record of responses and reinforcements to a variety of reinforcement schedules.
USE OF PROGRAM: Used in biology and psychology courses.
PREREQUISITES: Some introductory psychology courses.
TIME SPENT ON PLATO BY TYPICAL STUDENT: 5 hours
DESCRIPTIVE LITERATURE: None

PROGRAM NAME: MEANS-ENDS MOTIVATION
AUTHOR: J. L. Cohen
DESCRIPTION: Elicits from students the answers to means-ends questions in order to build a network of motivational constructs and probability estimates for comparisons among terms.
USE OF PROGRAM: Research
PREREQUISITES: College freshmen
TIME SPENT ON PLATO BY TYPICAL STUDENT: 4 hours
DESCRIPTIVE LITERATURE: None

PSYCHOLOGY (Cont.)

PROGRAM NAME: PROBLEM-SOLVING "SPY" PROGRAM
AUTHOR: J. L. Cohen
DESCRIPTION: Human learning and problem-solving program using distinguishable stage "spy" problems. General program easily modified for many variations. Good subject-experiment interaction and recording of data.
USE OF PROGRAM: Research
PREREQUISITES: College freshmen
TIME SPENT ON PLATO BY TYPICAL STUDENT: 2 hours
DESCRIPTIVE LITERATURE: None

PROGRAM NAME: STATISTICS FOR PSYCHOLOGY
AUTHORS: J. L. Cohen, L. Jones, C. Lewis
DESCRIPTION: Elementary statistics for psychological research. After finishing tutorial presentation, test and review, students design, program and execute their own problems. Programs include descriptive statistics, binomial distribution explanation, histograms and scatter plots, rank ordered data, and sampling distributions.
USE OF PROGRAM: Course segment (UI, PSY 235, 332)
PREREQUISITES: Introductory psychology.
TIME SPENT ON PLATO BY TYPICAL STUDENT: 30 hours
DESCRIPTIVE LITERATURE: None

RUSSIAN

PROGRAM NAME: BEGINNING RUSSIAN
AUTHORS: C. Curtin, D. Moor, C. Finch et al.
DESCRIPTION: Language Laboratory for beginning students. Includes drills, grammar, dialog techniques, etc..
USE OF PROGRAM: Language laboratory (UI, RUSS 101, 102)
PREREQUISITES: None
TIME SPENT ON PLATO BY TYPICAL STUDENT: 20 hours
DESCRIPTIVE LITERATURE: None

PROGRAM NAME: RUSSIAN READING
AUTHORS: C. Curtin, L. Woodruff, D. Clayton, C. Finch, D. Moor
DESCRIPTION: Introductory Russian to develop the ability to read unabridged technical prose (tutorial, "drill and practice"). Sufficient grammar and vocabulary presented and drilled to achieve the desired reading skill. Alphabet presentation and transliteration also introduced.
USE OF PROGRAM: CBE course for college undergraduates and graduates (no other classroom work) (UI, RUSS 121, 122, 400, 401)
PREREQUISITES: None
TIME SPENT ON PLATO BY TYPICAL STUDENT: 80 hours
DESCRIPTIVE LITERATURE: Curtin, C., "Russian Reading Program," note in Slavic and East European Journal, Summer 1971.
Curtin, C., L. Woodruff, D. Clayton, C. Finch, D. Moor, "Teaching the Translation of Russian by Computer," Modern Language Journal, (1972).

RUSSIAN (Cont.)

PROGRAM NAME: SCIENTIFIC RUSSIAN TRANSLATION
AUTHORS: C. Curtin, L. Woodruff, A. Anderson
DESCRIPTION: Three lessons in Scientific Russian for graduate students.
USE OF PROGRAM: Course segment, graduate level Russian course (UI, RUSS 400)
PREREQUISITES: None
TIME SPENT ON PLATO BY TYPICAL STUDENT: 2 hours
DESCRIPTIVE LITERATURE: None

SPANISH

PROGRAM NAME: Beginning Spanish
AUTHOR: A. Armengol
DESCRIPTION: Drill-and-practice in Spanish vocabulary, verb tense, and syntax.
USE OF PROGRAM: "Laboratory" practice in beginning Spanish (UI, SPAN 101, 102, 103, 212).
PREREQUISITES: None
TIME SPENT ON PLATO BY TYPICAL STUDENT: 30 hours
DESCRIPTIVE LITERATURE: None

STATISTICS

PROGRAM NAME: COMPUTE
AUTHOR: A. Avner
DESCRIPTION: Statistical service package computing descriptive statistics, parametric statistics, and binomial probabilities. Also demonstration showing central limit theorem, mean-variance relations and chi-square distributions.
USE OF PROGRAM: Service program used with lessons in several teaching areas to introduce statistical procedures for evaluation of student data (astronomy, biology, chemistry, mathematics, psychology...)
PREREQUISITES: High School math, introductory statistics.
TIME SPENT ON PLATO BY TYPICAL STUDENT: 2 hours (for instructional and demonstration segments).
DESCRIPTIVE LITERATURE: PLATO User bulletin.

URBAN PLANNING

PROGRAM NAME: BUDGET ALLOCATIONS
AUTHOR: C. Patton, T. Smith
DESCRIPTION: Simulation of effects of budget allocations to social programs upon social indicators.
USE OF PROGRAM: Demonstration program
PREREQUISITES: Urban planning courses
TIME SPENT ON PLATO BY TYPICAL STUDENT: 2 hours
DESCRIPTIVE LITERATURE: None

VETERINARY MEDICINE

PROGRAM NAME: BACTERIOLOGICAL UNKNOWNNS
AUTHORS: G. Grimes, H. Rhoades, R. Schmidt, F. Adams
DESCRIPTION: Inquiry and simulation techniques used in teaching the steps, materials, and interpretation of results in identifying bacteriological unknowns in a simulated laboratory.
USE OF PROGRAM: Course supplement (UI, VPH 331)
PREREQUISITES: Microbiology and 1 semester Veterinary Medicine Bacteriology
TIME SPENT ON PLATO BY TYPICAL STUDENT: 6 hours
DESCRIPTIVE LITERATURE: Grimes, G. M., H. E. Rhoades, F. M. Adams, and R. V. Schmidt, "Identification of Bacteriological Unknowns, a Computer-based Teaching Program," J. Med. Educ., 17 (April, 1972).
EVALUATIVE COMMENTS ON PLATO INSTRUCTION: Significant learning and excellent attitude towards PLATO instruction (78 students).

PROGRAM NAME: CALCIUM METABOLISM
AUTHORS: G. L. Jackson, R. Trynda, G. Grimes
DESCRIPTION: General relationship between hormones and calcium metabolism taught by graphic displays.
USE OF PROGRAM: Course segment
PREREQUISITES: Sophomore veterinary students
TIME SPENT ON PLATO BY TYPICAL STUDENT: 1 hour
DESCRIPTIVE LITERATURE: None

PROGRAM NAME: ENDOCRINOLOGY
AUTHORS: G. L. Jackson, R. Trynda, G. Grimes
DESCRIPTION: Effects of four hormones on blood glucose levels and stimulus for release of these hormones taught by graphic displays. Replaces a three hour "wet" laboratory session.
USE OF PROGRAM: Course segment (UI, VPP 316)
PREREQUISITES: Sophomore veterinary student
TIME SPENT ON PLATO BY TYPICAL STUDENT: 1 hour
DESCRIPTIVE LITERATURE: None

PROGRAM NAME: HISTOLOGY
AUTHORS: J. A. Harris, B. Williams, C. A. Tenczar
DESCRIPTION: CAI in histology of body tissues and organs; instruction is coordinated with slides of microscopic specimens.
USE OF PROGRAM: Course segment and demonstration.
PREREQUISITES: First year medical or veterinary student
TIME SPENT ON PLATO BY TYPICAL STUDENT: 3 hours
DESCRIPTIVE LITERATURE: None

VETERINARY MEDICINE (Cont.)

PROGRAM NAME: NERVE IMPULSE PATHWAYS
AUTHORS: A. E. Marshall, J. T. Silver
DESCRIPTION: Instruction in nerve pathways by simulated clinical tests
involving nervous system.
USE OF PROGRAM: Course segment and demonstration.
PREREQUISITES: Junior Veterinary student
TIME SPENT ON PLATO BY TYPICAL STUDENT: 2 hours
DESCRIPTIVE LITERATURE: None

PROGRAM NAME: VETERINARY DIAGNOSIS PROGRAM
AUTHORS: T. J. Burke, I. I. Musselman, G. M. Grimes
DESCRIPTION: Diagnosis and prescribed treatment and control of veterinary
clinical cases using student-computer dialogue techniques.
USE OF PROGRAM: Course or workshop segment
PREREQUISITES: Junior or higher veterinary student
TIME SPENT ON PLATO BY TYPICAL STUDENT: 3 hours
DESCRIPTIVE LITERATURE: None.

V. CHRONOLOGICAL LIST OF PLATO PUBLICATIONS

1. Bitzer, D. L., P. Braunfeld, "Automated Teaching Machine (PLATO)", Patent disclosure (April 6, 1961).
2. Bitzer, D. L., P. Braunfeld, and W. Lichtenberger, "PLATO: An Automatic Teaching Device," CSL Report I-103 (1961). Also appears as "PLATO: An Automatic Teaching Device," IRE Transactions on Education, E-4, 157-161 (December, 1961).
3. Bitzer, D. L., W. Lichtenberger, and P. G. Braunfeld, "PLATO II: A Multiple-Student, Computer-controlled Automatic Teaching Device," CSL Report I-109 (1961). Also appears as "PLATO II: A Multiple-Student Computer Controlled Teaching Machine," Programmed Learning and Computer-based Instruction, ed. by Coulson; John Wiley & Sons, New York, 205-216 (1962).
4. Bachman, R. G., "Application of a Computer-controlled Automatic Teaching System to Network Synthesis," CSL Report I-115 (1962).
5. Bitzer, D. L. and P. Braunfeld, "Description and Use of a Computer-controlled Teaching System," Proceedings of the National Electronics Conference, New York, 787-792 (1962). Also appears as "A Computer-Controlled Teaching System (PLATO)," New Media in Higher Education, ed. by Brown and Thornton, National Education Association, Washington, D. C., 108-110 (1963).
6. Bobotek, H., "Capacity of the PLATO II System Using the CSX-1 Computer as the Control Element," CSL Report I-118 (1962).
7. Braunfeld, P. G. and L. D. Fosdick, "The Use of an Automatic Computer System in Teaching," CSL Report R-160 (1962). Also appears as "The Use of an Automatic Computer System in Teaching," IRE Transactions in Education, E-5, 156-167 (September, 1962).
8. Bitzer, D. L., "PLATO: An Electronics Teaching Device," paper presented to the Annual Meeting of American Soc. Engineering Education, Philadelphia, Pa. (June, 1963). Also appears as "PLATO: An Electronics Teaching Device, Simulation Models for Education," Phi Delta Kappan (1964).
9. Bitzer, M., "Self-directed Inquiry in Clinical Nursing Instruction by Means of the PLATO Computer-Controlled Simulated Laboratory," CSL Report R-184 (1963). Also appears as "Clinical Nursing Instruction via the PLATO Simulated Laboratory," Nursing Research, 15(2) (Spring, 1966).

10. Avner, F. A., "Heart Rate Correlates of Insight," CSL Report R-198 (1964).
11. Avner, R. A., "Detection of Rate Changes in Periodic Phenomena," CSL Report R-235 (1964).
12. Bitzer, D. L. and J. A. Easley, Jr., "PLATO: A Computer-Controlled Teaching System," paper presented to the Annual Convention of the Department of Audiovisual Instruction, Rochester, New York (1964). Also appears as "PLATO: A Computer-Controlled Teaching System," Computer Augmentation of Human Reasoning, ed. by Sass & Wilkinson, Spartan Books, Washington, D. C., 89-103 (1965).
13. Braunfeld, P. G., "Problems and Prospects of Teaching with a Computer," Journal of Educational Psychology, 55, 201-211 (1964).
14. Easley, J. A., Jr., J. Gelder, and W. Golden, "A PLATO Program for Instruction and Data Collection in Mathematical Problem Solving," CSL Report R-185 (1964).
15. Hanson, A., S. Singer, and M. Walker, "Manual for PLATO Compiler," (1964).
16. Lyman, E. R., "A Descriptive List of PLATO Lesson Programs 1960-1964," CSL Report R-186 (1964); (revised 1965). Also published as CSL Report R-296 (1966); (revised 1967). Also published as CERL Report X-2 (1968); (revised 1970 and 1971).
17. Bitzer, D. L., E. R. Lyman, and J. A. Easley, Jr., "The Uses of PLATO: A Computer-Controlled Teaching System," CSL Report R-268 (October, 1965). Also appears as "The Uses of PLATO: A Computer-Controlled Teaching System," Audiovisual Instruction, 11(1), 16-21 (1966).
18. Bitzer, D. L., "The PLATO Teaching System," Automated Education Letter, 1(2), 13-15 (November, 1965).
19. Bitzer, D. L., A. J. Hanson, M. Secrest, S. Singer and M. Walker, "Compiler for Automated Teaching Operations," Patent Disclosure (December 27, 1965).
20. Bitzer, D. L., E. R. Lyman, and J. R. Suchman, "REPLAB: A Lesson in Scientific Inquiry Using the PLATO System," CSL Report R-260 (1965).
21. Hicks, B. L., "PLATO Program: VERBOSE," CSL Report I-129 (1965).
22. Easley, J. A., Jr., "First Annual Report for Project SIRA," SIRA Report to the U. S. Department of Health, Education and Welfare, Office of Education (October, 1965-September 1966).
23. Bitzer, D. L., H. G. Slottow, and R. H. Willson, "A Gaseous Discharge Display and Memory Mechanism," Patent Application (1966).

24. Willson, R. H., "A Capacitively Coupled Bistable Gas Discharge Cell for Computer Controlled Displays," CSL Report R-303 (1966).
25. Johnson, R., "The Use of Programmed Learning and Computer-based Instruction Techniques to Teach Electrical Engineering Network Analysis," CSL Report R-297 (1966). Also appears as "Using the PLATO Teaching System for Computer-based Instruction in Electrical Engineering," International Journal of Electrical Engineering Education, 5, Pergamon Press, Great Britain, 31-39 (January, 1967)
26. Fillman, L. A., "CSL PLATO System Manual (A revision of "Manual for PLATO Compiler" by A. Hanson, S. Singer, and M. Walder)," CSL (1966).
27. Schwartz, S. H., "A Paradigm for the Investigation Processes in Concept Attainment," CSL Report R-321 (1966).
28. Tatsuoka, K., "A Multiple Separation Function for Pattern Classification," CSL Report R-313 (1966).
29. Webber, C. W. and W. E. Montague, "PAVLEW: A Program for Verbal Learning Experiments on the PLATO System," CSL Report I-135 (1966).
30. Bitzer, D. L. and H. G. Slottow, "The Plasma Display Panel--A Digitally Addressable Display with Inherent Memory," Proceedings of the Fall Joint Computer Conference (November, 1966).
31. Montague, W. E. and A. J. Wearing, "The Effect of Complexity of Natural Language Mediators and the Associability of Pairs of Paired-Associate Learning," CSL Report R-333 (1967).
32. Uretsky, M., "Description of a PLATO Program to Teach Computer Programming," Automated Educational Systems, ed. by E. Haga, Business Press, Elmhurst, 313-335 (1967).
33. Bitzer, D. L., B. L. Hicks, R. L. Johnson, and E. R. Lyman, "The PLATO System; Current Research and Developments," IEEE Transactions on Human Factors in Electronics, 8, 64-70 (1967).
34. Arora, B. M., D. L. Bitzer, H. G. Slottow, and R. H. Willson, "The Plasma Display Panel---A New Device for Information Display and Storage," CSL Report R-346 (1967). Also appears as "The Plasma Display Panel--A New Device for Information Display and Storage," Proceedings of the Eighth National Symposium of the Society for Information Display, San Francisco (May, 1967).
35. Axeen, M., "Teaching the Use of the Library to Undergraduates: An Experimental Comparison of Computer-based Instruction and the Conventional Lecture Method," CSL Report R-361 (1967).

36. Wearing, A. J. and W. E. Montague, "Associability of CVC-word Pairs and Its Relation to List Difficulty," Psychon. Sci., 7(4) (1967).
37. Montague, W. E. and A. J. Wearing, "The Complexity of Natural Language Mediators and Its Relation to Paired-Associate Learning," Psychon. Sci., 7(4) (1967).
38. Bitzer, D. L., "Teaching by a Computer-based Instructional System," a paper presented to 1967 IEEE International Convention (March 20, 1967).
39. Montague, W. E. and A. J. Wearing, "The Retention of Response of Individual Stimuli and Stimulus Classes," Psychon. Sci., 9(2) (1967).
40. Montague, W. E. and A. J. Wearing, "Natural Language Mediation: A Source of Interference with Extra-experimental Interference," Psychon. Sci., 9(6) (1967).
41. Wearing, A. J., C. B. Walker, and W. E. Montague, "Recall of Paired-Associates as a Function of Their Associability," Psychon. Sci., 9(10) (1967).
42. Beberman M., "Terminal Report for the Institute in Educational Media at the University of Illinois" Report of the U. S. Department of Health, Education and Welfare, Office of Education (June, 1967 - August, 1967).
43. Osgood, C. E. and S. Umpleby, "A Computer-based System for Exploration of Possible Futures for Mankind 2000," Progress Report for Mankind 2000 (August, 1967). Also appears in Mankind 2000, ed. by Robert Jungk & Johan Galtung, Norwegian University Press, Oslo, 346-359 (1969).
44. Easley, J. A., Jr., "A Project to Develop and Evaluate a Computerized System for Instructional Response Analysis," Interim SIRA Report to the U. S. Department of Health, Education and Welfare, Office of Education (October, 1967).
45. Kingery, R. A., R. D. Berg, E. H. Schillinger, "A Computer in the Classroom," Chapter 12, Men and Ideas in Engineering, University of Illinois Press (1967).
46. Myers, M. and J. B. Gilpin, "PLATO: The Teacher's Mentor, Dialogues with a Computer," paper presented to the Modern Language Association Conference on Audio Visual Materials and Teacher-Training, Chicago (December, 1967). Also published in New York State Federation of Foreign Language Teachers Bulletin, 21(3) (April, 1970).
47. Avner, R. A., "SIRA--A System for Response Analysis," paper presented to the American Educational Research Association Annual Meeting, Chicago (February, 1968).

48. Bitzer, D. L., "Instruction in Medical Education," paper presented to the Conference on Computer-assisted Instruction in Medical Education, Harvard (February, 1968).
49. Hicks, B. L., "EVALTIK: PLATO-aided Student Evaluation of a Course," CERL Report N-1 (February, 1968).
50. Bitzer, D. L. and H. G. Slottow, "Principles and Application of the Plasma Display Panel," Proceedings of OAR Research Applications Conference, Office of Aerospace Research, Arlington, Va., AI-A43 (March, 1968). Also in Proceedings of IEEE Symposium on Micro-electronics and Electronic Systems, St. Louis Section and Professional Group on Parts, Materials and Packaging, C61-C610 (1968).
51. Trippon, M., "PLATO at Work," Phi Delta Kappan, XLIX-8, 439-441 (April, 1968).
52. Bitzer, D. L., "The Computer: A Flexible Guide to an Art Museum," Computers and Their Potential Applications in Museums, from a conference sponsored by Metropolitan Museum of Art, Arno Press, New York (April, 1968).
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54. Arora, B. M., "The Influence of Gas Composition and of Signal Waveform on Properties of the Plasma Display," CSL Report R-377 (May, 1968).
55. Lyman, E. R., "Instructions for Using the PLATO Logic, GENERAL," CERL Report X-1 (May, 1968).
56. Walker, C. B. and W. E. Montague, "Organization in Memory: A Bibliography," CERL Report N-2 (May, 1968).
57. Dennis, J. R., "Teaching Selected Geometry Topics via a Computer System," CERL Report X-3 (June, 1968).
58. Bitzer, M., "A Computer-based Course in Nursing," (with film narrative supplement). Paper presented to the 21st Annual Meeting of the Conference of Catholic Schools of Nursing (June, 1968).
59. Osgood, C. E., "On the Semantics of Interpersonal Verbs and the Norms of Interpersonal Behavior," Symposium Report on Language and Thought, University of Arizona Press (1968).
60. Lyman, E. R., "Computer-based Education," Illinois School Board Journal, 35(4) (July-August, 1968).

61. Bitzer, D. L. and J. A. Easley, Jr., "PLATO III: A Computer-Based System for Instruction and Research," Proceedings of the 16th International Congress of Applied Psy., Amsterdam (August, 1968).
62. Bitzer, D. L., "Some Pedagogical & Engineering Design Aspects of Computer-based Education," paper presented to the Naval Training Station, China Lake, California (August, 1968).
63. Final Report of E. H. 297 Class, "Programmed Instruction for the Blind," Univ. of Ill. Eng. Pub. Office (Summer, 1968).
64. Bitzer, D. L., "An Economically Viable Large Scale Computer-based Education System," paper presented to the Conference on Computer-Assisted Instruction, Penn State (September, 1968). Also found in Computer-Assisted Instruction and the Teaching of Mathematics, ed. by the National Council of Mathematics, Penn. State, 17-23 (1969).
65. Easley, J. A., Jr., "A Project to Develop and Evaluate a Computerized System for Instructional Response Analysis," SIRA Report to the U. S. Department of Health, Education and Welfare, Office of Education (September, 1968).
66. Bitzer, D. L. and D. Skaperdas, "The Economics of a Large Scale Computer-based Education System, PLATO IV," paper presented to the Conference on Computer-based Instruction, Learning and Teaching Education, Texas (October, 1968).
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68. Dennis, J. R., "Geometry Via PLATO," The Instructor, 116, (November, 1968).
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70. Bitzer, D. L. and D. Skaperdas, "The Design of an Economically Viable Large-Scaled Computer-based Education System," paper presented to the Commission on Instructional Technology, CERL Report X-5 (December, 1968).
71. Myers, M. K., "Essential Components of a Student CAI Terminal," paper presented at the American Association for the Advancement of Science Meeting, Dallas, Texas (December, 1968).
72. Avner, R. A. and P. Tenczar, "The TUTOR Manual," CERL Report X-4 (1969); (revised Summer 1971).

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82. Umpleby, S., "The Delphi Exploration: A Computer-based System for Obtaining Subjective Judgments on Alternative Futures," Social Implications of Science and Technology, Report F-1, University of Illinois, CERL. (August, 1969).
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